UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td>Title of the Course</td><td colspan="8">ELEMENTS OF MATHEMATICAL ANALYSIS</td></tr>
<tr><td>Paper Number</td><td colspan="8">CORE M8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2">234C4B</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">5</td></tr>
<tr><td>Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="8">• Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series.
• Understand metric spaces with suitable examples</td></tr>
<tr><td>Course Outline</td><td colspan="8">Unit I: Sets and Functions: Sets and Elements – Operations on Sets – Functions – Real Valued Functions – Equivalence – Countability – Real Numbers-least Upper Bounds.
Chapter 1 Sections 1.1 – 1.7. Hours: 15</td></tr>
<tr><td></td><td colspan="8">Unit II: Sequences of Real Numbers: Definition of a Sequence and Subsequence – Limit of a Sequence – Convergent Sequence – Divergent Sequences – Bounded Sequences – Monotone Sequences.
Chapter 2 Sections 2.1 – 2.6 Hours: 15</td></tr>
<tr><td></td><td colspan="8">Unit III: Operations on Convergent Sequences – Operations on Divergent Sequences – Limit Superior and Limit Inferior – Cauchy Sequences.
Chapter 2 Sections 2.7 – 2.10. Hours:15</td></tr>
<tr><td></td><td colspan="8">Unit IV: Series of Real Numbers: Convergence – Divergence – Series With Non-Negative Terms – Alternating Series – Conditional Convergence and Absolute Convergence – Tests for Absolute Convergence.
Chapter 3 Sections 3.1 – 3.4 and 3.6. Hours: 15</td></tr>
<tr><td></td><td colspan="8">Unit V: Limits and Metric Spaces: Limit of a Function on a Real Line – Metric Spaces – Limits in Metric Spaces – Continuous Functions on Metric Spaces – Function Continuous at a Point on the Real Line – Function Continuous on a Metric Space.
Chapter 4 Sections 4.1 – 4.3, Chapter 5 Sections 5.1 – 5.3
Hours: 15</td></tr>
<tr><td></td><td colspan="8">Total Hours:75</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Methods of Real Analysis by Richard R. Goldberg, Oxford and IBH Publishing, (1 January 2020).
Reference Books	1. Calculus (Vol. I), T. M. Apostol, John Wiley and Sons (Asia) P. Ltd., 2002. 2. Introduction to Real Analysis, R.G. Bartle and D. R Sherbert, John Wiley and Sons (Asia) P. Ltd., 2000. 3. Intermediate Real Analysis, E. Fischer, Springer Verlag, 1983. 4. Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, K.A. Ross, Springer Verlag, 2003. 5. Real Analysis – I by Dr. A.E. Krishnan, Sri Krishna Publications
Website and e-Learning Source	https://nptel.ac.in https://www.mathhelp.com/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain in detail about sets and functions, equivalence and countability and the LUB axiom

CLO 2: Explain Sequence and Subsequence of real numbers and to find the limit of sequence to test forconvergent, divergent, bounded and monotone sequences

CLO 3: Explain the operations on convergent and divergent sequences and to explain the concepts of limitsuperior and limit inferior and the notion of Cauchy sequences

CLO 4: Classify the series of real numbers and the alternating series and their convergence and divergence,the conditional convergence and absolute convergence and solve problems on convergence of the sequences

CLO 5: Explain about the metric spaces and functions continuous on a Metric space

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO 1	3	3	2	3	2	-	3	2	1
CLO 2	3	3	2	3	2	-	3	2	1
CLO 3	3	3	3	3	2	-	3	2	1
CLO 4	3	3	3	3	2	-	3	2	1
CLO 5	3	3	2	3	2	-	3	2	1